Instrument FSW - Approach/Review

9/19/2001

Near Term Activities

- **Decision to allocate the Instrument processor related HW and SW control functions to the FAME Spacecraft Controller was made 9/5/2001**

- **This package summarizes the activities and outlines pre-PDR plans related to the decision.**

- **Enlist program support wherever possible to accomplish pre-PDR objectives.**

Primary Objectives Prior to PDR

- **Bus/Instrument Interface Definition**

- **Capture of Overall Instrument FSW Requirements**

- **Algorithm Selection**

- **Processor Throughput Analysis and Test**

- **Software Team Organization and Development Plan**

- **High Level Design**

- **Instrument Test Approach**

Bus/Instrument Interface Definition

- **Resources to date:**
  - Primary discussions have been between LM ATC (Earl Aamodt, Peter Ogden and Mike Wagner) and NRL (Brian Davis and John Gambert)
  - Additional review feedback has been received from others at NRL, LM ATC and USNO

- **Activities to Date:**
  - For the last two weeks, almost daily review and definition discussions have taken place.

- **Products to Date:**
  - Bus/Instrument Interface Review Package (powerpoint)

- **Plans:**
  - Continue using review package until interface stabilizes and then transfer the information to the Bus/Instrument ICD (Hardware).

Capture of Overall Instrument FSW Requirements

- **Resources to Date:**
  - **Instrument Requirement Document (IRD), 22-May Draft**
  - **Discussions with Dave Fish and Chin-an Cheng**

- **Activities to Date:**
  - **Reviewed IRD**

- **Products to Date:**
  - **None**

- **Plans:**
  - **Capture requirements into the Observatory FSW requirements specification**
    - **Will contain combined Bus and Instrument FSW requirements**
  - **Utilize NRL, LM ATC and USNO personnel to review and refine, as needed, the Instrument FSW requirements**
  - **Perform a Program level review of the FSW requirements prior to PDR**
    - **Schedule TBA**

Algorithm Selection

- **Resources to Date:**
  - **Technical Memos (Rob Olling, George Kaplan, Roel Vanbezooijen)**
  - **E-mail/Attachments from Algorithm Working Group members**
  - **Draft Template of the Algorithm Description Document (ADD)**

- **Activities to Date:**
  - **Discussed algorithm status and approach with Roel and Dave Fish**
  - **Distributed draft template of the ADD**

- **Products to Date:**
  - **None**

- **Plans:**
  - **Work a plan during the TIM to complete a full draft of the ADD prior to PDR**
  - **Seek ongoing support from the Algorithm Working Group members (and others) to review and refine the ADD**
  - **Schedule telecons, as required, to support ADD development**
  - **Utilize prototype code development, where necessary, to support algorithm assessment and selection.**

Processor Throughput Analysis and Test (1 of 2)

- **Resources to Date (From Dave Fish, Bob Drake and Chin-an Cheng):**
  - **Notes**
  - **Presentation Material**
  - **Estimations**
  - **Measured and scaled results from prototype code**
  - **Prototype source code and star catalog data files**

- **Activities to Date:**
  - **Discussed throughput analysis status with Dave Fish**
  - **Currently in the process of obtaining prototype source code and data files (I.e. star catalog) from LM ATC - Dave Fish, Chin-an Cheng and Bob Drake are supporting this effort.**
  - **LM ATC is in the process of providing additional description and documentation in support of the prototype code and data files**
  - **NRL FSW team is preparing FSW development environment to support the adaptation of the existing prototype code for execution on the RHC-3001 target**

- **Products to Date:**
  - **FAME application is being prepared to support Instrument FSW prototype code integration**
  - **FSC engineering unit is ready to support FSW prototype code execution using a partial Star Catalog**

Processor Throughput Analysis and Test (2 of 2)

- **Plans:**
  - Refine Bus and Instrument processor throughput requirements
  - Use available RHC-3001 based FAME Bus application (RM & CT) and existing ICM Application (RM, CT & ADAC) to obtain a Bus processing throughput estimate.
  - Adapt key portions of the Science Data collection prototype code to the VxWorks and RHC-3001 environment to obtain Science Data collection processing throughput estimate.
  - Coordinate these efforts with the activities of the Algorithm Working Group members and the ongoing development of the ADD.
  - This effort is both dependent on the algorithm selection, but can provide feedback relating to algorithm efficiency.
  - Continue to coordinate with LM ATC team to utilize their experience with prototype implementations and utilize their prototype development and execution environment (w/support form Roel, Dave & Bob).

Software Team Organization and Development Plan

- **Resources to Date:**
  - LM ATC FSW and System Engineering Team
  - NRL FSW Team
  - Enlisted help from Bob Stapleford and Jim VanGaasbeck to provide added Pre-PDR (and post-PDR) Instrument FSW system engineering support
  - Existing Bus and Instrument Flight SW Development Plans

- **Activities to Date:**
  - Discussed LM ATC Flight SW activity, requirements, design and prototype status with LM ATC FSW team

- **Products to Date:**
  - None

- **Plans:**
  - Discuss pre and post PDR FSW team organization approaches with NRL and LM ATC management (during the TIM)
    - Decide on pre-PDR team organization ASAP (during TIM)
    - Work on long term (post-PDR) team organization and integration issues - initial plan by 9/28
  - Generate a draft Observatory Flight SW Development Plan prior to PDR - balance budget constraints, available resources, development approach with risks

High Level Design (PDR preparation)

- **Resources to Date:**
  - **LM ATC IPDR package**
  - **Existing FSW requirements (IRD)**
  - **LM ATC FSW team support**

- **Activities to Date:**
  - **Reviewed existing material**

- **Products to Date:**
  - **None**

- **Plans:**
  - **Design decisions will be based on:**
    - **Existing design approach from LM ATC**
    - **Results from combined requirements**
    - **Algorithm Selection**
    - **Processor throughput analysis and test results**
    - **Integration approach of instrument functionality with FAME application (ICM based)**

  - **Some key decisions**
    - **Full redundancy** (Full Bus/Instrument functionality on a single processor) or **Distributed Processing** (Bus/Instrument functionality distributed across two processors with degraded capability in the presence of a processor failure)
    - **Explore options with respect to requirement allocation between flight and ground processing**
      - **Investigate feasibility of utilizing ground processing assets for acquisition and/or fine attitude/rate determination**

Instrument Test Approach - From a control and data standpoint

- **Resources to Date:**
  - **LM ATC IPDR package**
  - **USNO, LM ATC and NRL personnel**

- **Activities to Date:**
  - **Reviewed some material**

- **Products to Date:**
  - **None**

- **Plans:**
  - **Develop an integrated program approach to testing in light of the processor allocation**
    - **Organize and define a plan to document test approach during the TIM (9/20)**

  - **Identify test and calibration requirements, HW & SW requirements and a high level schedule associated with each of the following activities:**
    - **Instrument Standalone testing**
    - **FSW Standalone testing**
    - **Integration of Bus CT&DH (HW & SW) with the Instrument at LM ATC**
    - **Observatory integration at NRL**
    - **On-Orbit test and calibration activities**